**Agenda item:** 9.8

**Source:** Qualcomm Incorporated

**Title:** [5MBUSA] Hybrid Services

**Document for** Discussion andAgreement

# Introduction

This document addresses the following aspects identified in S4-210975 aspects:

1. Define 5G Media Streaming services delivered via 5MBS, including hybrid unicast/broadcast services.

2. Define 5G Media Streaming services delivered via eMBMS, including hybrid unicast/broadcast services.

This relates to the objective documented in clause 4.

3. Extend the 5G Media Streaming architecture by providing a general description and architecture of:

b. 5GMS hybrid unicast/broadcast services.

This document focuses on only the first part, i.e. hybrid services via 5MBS and unicast. The combination of 5GMS and eMBMS follows the same principles.

This document takes assumptions from S4-211005 and S4-211008 as agreed, and summarized in clause 2.

In addition, TR 26.802 clause 5.7.3 documents

As a result of the content of this technical report, the following next steps are proposed:

1. Architectural Extensions: Architecture and call flows for the following hybrid 5GMS unicast and 5MBS scenarios with high priority (based on existing functionalities in eMBMS): (i) Interactive Service, (ii) Session Continuity, (iii) Time-shifted viewing, (iv) Targeted content replacement, (v) Reporting, and (vi) Unicast recovery. Additional functionalities such as (i) Enhanced service quality, (ii) Component replacement, and (iii) Fast start-up may be addressed as well if time permits.

2. Protocol Extensions: The required functions of the reference points for hybrid services need to be checked against existing functions in TS 26.501, TS 26.511, TS 26.512, TS 26.346, TS 26.347 and TS 26.348 and extended if needed.

1. Assumptions

Figure 3.1-1 updates Figure 5.1-2 from TS 23.247 to provide a more user service centric view. It also provides an update to Figure 4.4.3-1 from TR 26.802. The red highlights provide the main scope for User Service Specification from a northbound interface.



**Figure 3.1-1 User Service Centric 5G MBS system architecture in reference point representation**

In Figure 3.1-2, a proposed update to the 5MBS User Service Architecture is proposed that addresses the different interfaces defined in the work item description.



**Figure 3.1-2 5G Multicast Broadcast User Service (5MBUS) Architecture**

The following definitions are assumed

**Application Service**: An end-user service for which parts of the data or all of the data of this service is accessible by joining an 5MB User Service.

**5MB User Service:** The transport-level service using an MBS Delivery Sessions to delivery an Application Service.

**MBS delivery session:** time, protocols and protocol state (i.e. parameters) which define sender and receiver configuration and use an MBS session for the delivery of an application data session.

**Application data session:** time, protocols and protocol state (i.e. parameters) provided by an 5MBS application provider for delivery over 5MBS and provided to the 5MBS aware application.

This concept is now also presented in the below Figure



Initial session and service procedures are provided in Figure 6-1.



**Figure 6-1 5MB User Service Workflow**

The architecture in Figure X below represents a harmonized architecture for 5G Media Streaming via 5MBS for which the 5GMSd AS is hosted in the 5MBS client.



**Figure X Harmonized architecture for 5G Media Streaming over 5MBS**

The above case refers to one of the deployment options as indicated also in Annex A of TS 26.501.

- Be addressed with a single FQDN.

The second case addresses the scenario for which the service is exclusively being provided through 5 MBS and no unicast for data delivery exists.

# Hybrid Cases from TR 26.802

With reference to the architecture depicted in Figure 4.4.5.4-2, Table 6.3.2-1 provides impacted reference points for the ten different hybrid scenarios described in clause 5.7.2.3.

**Table 6.3.2-1: Impacted Reference Points for different hybrid scenarios**

|  |  |  |
| --- | --- | --- |
| **Scenario** | **Impacted reference points** | **Requirements** |
| 1 - Fast startup via unicast while the 5MBS Client is waiting for initial multicast/broadcast packets to start arriving via MBS 4. | M1: General Provisioning and fast startup feature is provisioned.M2: General ingest and signaling of unicast fast start-up Representations in presentation manifest.M4: Signaling of the unicast available content and the content available on 5MBS in the manifest.M4: Signaling availability of unicast fast start-up Representations in manifest.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.M5: Potential usage of dynamic policies and/or network assistance for unicast fast start-up Representations.MBS-4-MC: 5BMS object delivery of non-fast-start up Representations.MBS-6: Announcement of non-fast-start up Representations by 5MBS Client.MBS-7: Providing the non-fast-start up Representations from 5MBS Client. | Fast start-up Representations need to be available on 5GMS AS for early access.The Media player needs to be able to switch to 5MBS distribution once the same content is available on unicast. |
| 2 - Unicast recovery of the application payload data carried in multicast/broadcast packets that are not successfully received via MBS 4, in a manner that is transparent to the 5GMS Client | M1: General ProvisioningM2: General Ingest.MBS-5: Service announcement including signaling of unicast repair server.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS object delivery of content Representations.MBS-4-UC: File repair.MBS-7: Partial file delivery in case repair fails or delivery timeline is expired. | The unicast URLs need to be announced to the 5MBS Client. |
| 3 - Session continuity when multicast/broadcast service is temporarily unavailable, in a manner that is transparent to the 5GMSd-aware application | M1: Session-continuity feature is provisioned.M2: Ingest of content by 5GMS AS.M4: Signaling availability of different content on different delivery means in the manifest, on 5GMS AS and on 5MBS.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content for 5MBS distribution.MBS-5: Signaling of identical and alternative content.MBS-4-MC: 5MBS object delivery of content Representations.MBS-4-UC: File repair for session continuity for certain amount of time.MBS-7: Dynamic switching of Media Player from 5MBS content to unicast content (panic button) when unicast repair starts to fail.MBS-6/M6: Availability information of 5MBS distribution. | The 5MBS client needs to inform the Media Player about the (non-) availability and of resources through 5MBS distribution.The service also needs to work with low-latency DASH. |
| 4 - MooD Switching the operating mode of a 5GMS session to unicast under the direction of network-based multicast operation on demand (MooD), in a manner that is transparent to the 5GMS Client | No considerations for this Release | None. |
| 5 - Enhanced service quality for which content quality is enhanced by additional unicast (e.g. through scalable/layered coding or equivalent means). | M1: General provisioning and enhanced service quality feature is provisioned.M2: General Ingest including of enhanced quality content ingest by 5GMS AS.M4: Signaling availability of different content on different delivery means in the manifest, on 5GMS AS and on 5MBS.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS distribution of content Representations.M4: Unicast distribution of enhanced service quality.M5: Optional use of dynamic policy and network assistance on unicast distribution. | The 5MBS Client needs to support the retrieval of components from 5MBS and unicast at the same time.The service also needs to work with low-latency DASH. |
| 6 - Component replacement for example a component provided over 5MBS session is replaced by a unicast component | M1: General provisioning Component replacement feature is provisioned.M2: Ingest of replacement content by 5GMS AS.M4: Signaling availability of different content on different delivery means in the manifest, on 5GMS AS and on 5MBS..Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS object delivery of content Representations.M4: Unicast distribution of replacement component.M5: Optional use of dynamic policy and network assistance on unicast distribution. | The 5MBS client needs to support to retrieve components from 5MBS and unicast at the same time.The service also needs to work with low-latency DASH. |
| 7 - Time-shifted viewing a 5GMSd client decided to watch the service in timeshift mode and hence switches to unicast distribution | M1: Time-shifted viewing feature is provisioned.M2: Ingest of time-shifted content.M4: Signaling availability of different content on different delivery means in the manifest, on 5GMS AS and on 5MBS..Nmb2: identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS object delivery of content Representations.M4: distribution of time-shifted content. | The transition should be seamless, i.e. in a way that the user is not aware that the delivery mode is changed. |
| 8 – Targeted content replacement for example for ad insertion (targeted to users, regions, etc.). | M1: Replacement content on unicast is provisioned.M2: Ingest of replacement content.M4: Signaling availability of different content on different delivery means in the manifest, on 5GMS AS, and on 5MBS.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5BMS distribution of live main content.M4: Distribution of targeted unicast content for replacement.M5: Optional use of dynamic policy and network assistance on unicast distribution. | The transition between unicast targeted content and 5MBS content is expected to be seamless |
| 9 – Reporting is done also for the 5MBS service | M1: Reporting feature is provisioned.Nmb2: Identification of content for 5MBS distribution.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS object delivery of content.M5: Reporting. |  |
| 10 - Interactive service for example with a presentation layer being included | M1: Interactive content distribution is provisioned.M2: Ingest of interactive content.Nmb2: Identification of content for 5MBS distribution.M8: Content is announced through interactive application.M4: Presentation Layer content is delivered that includes reference to multiple content items delivered over 5MBS.M6/M7/MBS-6: Find content on 5MBS.Nmb4/xMB-U: Ingest of content by MBSTF for 5MBS distribution.MBS-4-MC: 5MBS object delivery of content. |  |

# Hybrid Architecture

For the hybrid architecture, the 5GMS deployment option 2 as indicated also in Annex A of TS 26.501 is considered.

- Consist of multiple (physical) servers, where different servers, or different groups of servers, may be addressed with different FQDNs. The client may be made aware of this via the manifest (i.e. listing multiple base URLs).

NOTE: In this case the servers may be managed by the same or different parties (e.g. MNO and/or 5GMSd Application Provider).

The first case addresses the scenario, for which parts of the service are also available on unicast, i.e. the hybrid case. This is the subject of this contribution. In this case two distinct 5GMS AS are maintained, one on the Data Network and one in the 5MBS client, typically part of the UE. The Media Player may use either or both 5GMS AS to receive data.



**Figure Y Harmonized architecture for 5G Media Streaming over 5MBS with hybrid option**

# Call Flows and Procedures

## 5.1 General

The initial call flow addresses the delivery of 5GMS media in a hybrid mode using unicast and 5MBS. This call flow is generic for the hybrid use case. For specific use cases, some specific details need to be added.



**Figure X: High Level Procedure for DASH content via Hybrid**

Steps:

1: The 5GMSd Aware Application triggers the Service Provisioning and permits hybrid distribution of the media content

2: The 5GMS AF provisions 5MBS User service by communicating with the MBSF. The MBSF sets up the MBS delivery sessions and informs the 5GMS AF on ingest resources.

1b): The 5GMS AF provider modifies the manifest to provide the different resources as available either on a DN or on 5MBS hosted 5GMS AS. The manifest and the ingest resources are provided to the 5GMS Application Service Provider. The manifest may also be updated by the 5GMS Application Service Provider.

3: The media content is announced to the 5GMSd-aware application and the application request the entry points for the service.

4: Ingest starts from the 5GMSd Application Providers and the 5GMS AS may forward directly content that is delivered through to the MBSTF.

5: The MBSTF starts one or several MBS Delivery Sessions. Different modes are possible, depending whether this is a Multicast or Broadcast session.

6: The media content is selected by the application

7: The application initiates the media playback through the media player and Media session handler.

8: The media session handler requests the service access information from the 5GMS AF (optional)

9: The media session handler identifies a hybrid service and based on this initiates 5MS User service reception and starts the service.

10: The media session handler informs the application that the service is ready

11: The application starts media playback

12: The MPD/manifest is requested by the Media Player. The manifest may be on the local 5GMS AS (populated by the 5MBS delivery) or on the 5GMS AS on the DN or even on both.

13: The Media Player processes the MPD and identifies that resources are available on different 5GMS AS

14: The Media Player continuously checks with the Media Session handler and possibly forwarded to the 5MBS client if the 5MBS User Service data is available, how to use the different content. This depends on the hybrid scenario

19: The Media Player requests initialization information either from local or remote 5GMS AS. The Media Player repeats this step for each required initialization segment.

20: The Media Player receives the initialization information.

21: The Media Player requests media segments according to the MPD either from local or remote 5GMS AS.

22: The Media Player receives media segments and puts the information into the appropriate media rendering pipeline.

23: Previous steps are repeated according to the MPD information.

## 5.2 Interactive Service

In this case,

* Streaming may be provided exclusively over 5MBS
* The 5GMS AS on the network is only used to host resources related to the interactive presentation. The 5GMS AS may also be used for DRM related exchange.

## 5.3 Session Continuity

In this case,

* The entire Media presentation is provided on the 5GMS AS in the Data Network
* In addition, for each CMAF Switching Set in the manifest, one Track is provided on 5MBS
* The MBSF informs the 5GMS AF to use the resources provided on 5MBS if 5MBS is accessible. If 5MBS is unavailable, the unicast version is used.
* Unavailability may be because of 5MBS is not supported in the network or on the client, or it may be because the 5MBS service is not coverage

## 5.4 Time-shifted viewing

In this case,

* The entire Media presentation is provided on the 5GMS AS in the Data Network
* In addition, for each CMAF Switching Set in the manifest, one Track is provided on 5MBS
* If the client decides to consume the information in time shift and the resources are not available on the 5GMS AS on the client, the Media Player switches to unicast.

## 5.5 Targeted content replacement

In this case,

* The entire Media presentation is provided on the 5GMS AS in the Data Network
* In addition, for each CMAF Switching Set in the manifest, one Track is provided on 5MBS
* For a specific period in the content, an alternative is available.
* The media player may select this alternative and replace the content by content available on the AS in the DN

## 5.6 Reporting

tbd

## 5.7 Unicast recovery

tbd

# Proposal

It is proposed to

* Adopt the architecture in clause 3 for hybrid use cases.
* Document the general procedures for hybrid scenario as listed in clause 4 in TS 26.502. A proper pCR will be provided once agreed.
* Continue to refine the call flows for specific hybrid scenarios
* Continue the work on hybrid services also 5GMS over eMBMS.